

AD
Q17
1 1. A method for allowing a user to remotely control a movement of
2 a surgical instrument having a tip, the method comprising the
3 steps:

4 a) establishing an original position of the instrument tip;

5 b) inputting a command provided by a user to move the
6 surgical instrument in a desired direction relative to an object
7 displayed on a display device;

8 c) computing an incremental movement of the surgical
9 instrument based on the command provided by the user and on the
10 original position of the instrument;

11 d) moving the instrument in the desired direction so that
12 the surgical instrument tip always moves in the direction
13 commanded by the user.
14

1 2. A method for using a robotic system having a plurality of
2 linkage arms to remotely control the movement of a surgical
3 instrument having a tip, the method comprising the steps:

4 a) read the joint angles of a robot having a surgical
5 instrument attached thereto and computing the forward kinematics;

6 b) detect a move command;

7 c) determine movement direction and establish appropriate
8 incremental movement in a double prime coordinate system;

9 d) transform incremental movement in double prime coordinate
10 system to incremental movement in a single prime system;

- 11 e) transform incremental movement in single prime coordinate
 - 12 system to incremental movement in a world coordinate system;
 - 13 f) add incremental movement to current position;
 - 14 g) compute new angles for robotic linkage arms;
 - 15 h) move robotic assembly to new positions;
 - 16 i) compute new pi value;
 - 17 j) move to new orientation.
- 1 3. A method for using a robotic system having a plurality of
- 2 linkage arms to remotely control the movement of a surgical
- 3 instrument having a tip, the method comprising the steps:
- 4 a) read the joint angles of a robot having a surgical
 - 5 instrument attached thereto and computing the forward kinematics;
 - 6 b) detect a move command;
 - 7 c) determine movement direction and establish appropriate
 - 8 incremental movement in a double prime coordinate system having
 - 9 an x, y and z axis;
 - 10 d) transform incremental movement in double prime coordinate
 - 11 system to incremental movement in a single prime system having an
 - 12 x, y and z axis;
 - 13 e) transform incremental movement in single prime coordinate
 - 14 system to incremental movement in a world coordinate system
 - 15 having an x, y and z axis;
 - 16 f) add incremental movement to current position;
 - 17 g) compute new angles for robotic linkage arms;

18 h) move robotic assembly to new positions;
19 i) compute new pi value;
20 j) move to new orientation.

1 4. The method of Claim 3 wherein the surgical instrument defines
2 the double prime coordinate system.

1 5. The method of Claim 4 wherein the surgical instrument is
2 located within a triple prime coordinate system having an x, y
3 and z axis.

1 6. The method of Claim 5 further including the steps of
2 computing an angle of rotation of the surgical instrument such
3 that the double prime x axis is orthogonal to a cross-product of
4 a vector of the double prime z axis and a vector of the triple
5 prime z axis, and rotating the surgical instrument the computed
6 angle of rotation.

1 7. The method of Claim 1 wherein the step of inputting a command
2 comprises a save command.

1 8. The method of Claim 1 wherein the step of inputting a command
2 comprises a return command.

1 9. The method of Claim 3 wherein the step of detecting a move
2 command comprises detecting a return command.

1 10. The method of Claim 2 wherein the step of detecting a move
2 command comprises detecting a return command.